MAIL STOP APPEAL BRIEF - PATENTS
PATENT
2328-059

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Appeal of	: Confirmation No. 4056
Rajinder DHINDSA et al.	: Art Unit: 1763
Serial No.: 10/032,279	: Examiner: Anna M. CROWELL
Filed: December 31, 2001	:

For: PLASMA PROCESSOR IN PLASMA CONFINEMENT REGION WITHIN A VACUUM CHAMBER

Filed: April 15, 2005

BRIEF ON APPEAL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Further to the Notice of Appeal filed February 15, 2005, in connection with the above-identified application on appeal, herewith is a copy of Appellants' Brief on Appeal. Authorization for payment of the $500 statutory fee is attached.

To the extent necessary, Appellants hereby request any required extension of time under 37 C.F.R. §1.136 and hereby authorize the Commissioner to charge any required fees not otherwise provided for to Deposit Account No. 07-1337.

CERTIFICATION OF FACSIMILE TRANSMISSION
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TABLE OF AUTHORITIES

I. Real Party in Interest

The real party in interest is Lam Research Corporation, a leading manufacturer of equipment that uses plasma for etching features on integrated circuits. The company website is http://www.lamrc.com.

II. Related Appeals and Interferences

There are no related appeals and/or interferences.

III. Status of Claims

Claims 21-24, 27-35, 38-43 and 66-75 are pending. Claims 1-20, 25, 26, 36, 37 and 44-65 are canceled. All pending claims are stated to be rejected in a March 7, 2005 Advisory Action, although the October 15, 2004 Final Rejection stated "Claims 74 and 75 would be allowable if rewritten to overcome the rejection(s) under 35 USC 112, 2nd paragraph, set forth in this Office Action and to include all of the limitations of the base claim and any intervening claims."

IV. Status of Amendments

A November 18, 2004 Amendment under 37 CFR 1.116 was not entered. A February 15, 2005 Amendment under 37 CFR 1.116 was entered. Appellants submit simultaneously with this Brief a further amendment under 37 CFR 1.116 that cancels claims 44-51; Appellants presume this amendment will be entered and are proceeding in this Brief on that assumption.

V. Summary of Claimed Subject Matter

A vacuum plasma processor 10 for etching materials from and depositing materials on a workpiece, typically an integrated circuit substrate (paragraph 3), includes a vacuum plasma chamber 12 (paragraph 23) for processing a workpiece 36 (paragraph 24). The chamber includes: (1) a first electrode 22 (paragraph 23) that is electrically coupled with gas in the chamber and connected to a first relatively high frequency RF source 54 (paragraph 33); (2) a second electrode 34 (paragraph 24) that carries workpiece 36 and is electrically coupled with gas in the chamber and connected to a second relatively low frequency RF source 60 (paragraph 33); (3) an exterior wall 14 at a reference potential, e.g., ground (paragraph 23); and (4) a plasma excitation region 38 that confines the plasma (paragraph 25). Region 38 is spaced from exterior wall 4 (paragraph 26).

The plasma excitation region includes (1) louvers in the form of louvre rings 41-43 (paragraph 26), (2) first and second surfaces at the reference potential and (3) electrodes 22 and 34. Rings 41-43 are spaced from wall 14 (paragraph 26 as well as Figs. 1 and 2). Plasma excitation region 38 is arranged so that gas flows into the plasma excitation region through the first electrode 22 (paragraph 25) and un-ionized gas flows out of the plasma excitation region between the rings 41-43 (paragraph 27). From rings 41-43, the un-ionized gas flows to passage 48 connected by an opening (i.e., a port) coupled to a pump that maintains chamber 12 at a vacuum (paragraph 27, Fig. 2).

The first surface is in the form of the upper exposed face of ring 29 (Figs. 1 and 2), and that is at RF and DC ground potential (paragraph 24), and is located between rings 41-43 and electrode 34 that carries workpiece 36 (Figs. 1 and 2). The second surface, in the form of the lower exposed face of ring 21 (Figs. 1 and 2) that is at RF and DC ground potential (paragraph 23), is located between rings 41-43 and first electrode 22. Hence, plasma excitation region 38 is bounded by electrodes 22 and 34 conducting rings 21 and 29 and louver rings 41-43 (paragraph 29).

Excitation region (38) has a geometry such that different dielectric sheaths are developed between the plasma in the excitation region and between each of (1) electrode 34 that carries workpiece 36, (2) first electrode 22 and (c) the exposed surfaces of rings 21 and 29 at the reference potential (paragraphs 18, 29, 30).

The geometry of excitation region 38 is such that current at the low 2 MHZ frequency of source 60 has a tendency to flow to a greater extent between electrode 34 for carrying workpiece 36 and first electrode 22 than from electrode 34 to the surfaces of rings 21 and 29 at the reference potential (paragraphs 18, 30).

The excitation region geometry is also such that current at the high frequency of 27 MHZ source 54 has a tendency to flow to a greater extent between first electrode 22 and the surfaces of rings 21 and 29 that are at the reference potential than from

first electrode 22 to electrode 34 for carrying the workpiece (paragraphs 18, 30).

A filter arrangement 58, 64 is connected to the first and second RF sources 54 and 60 and the first and second electrodes 22 and 34 (paragraphs 34, 36). Filter arrangement 58, 64: (1) enables current from the first RF source 54 to flow to the first electrode 22, (2) prevents the substantial flow of current from the first RF source 54 to the second electrode 34 and the second RF source 64, (3) enables current from the second RF source 60 to flow to first and second electrodes 22 and 34, and (4) prevents the substantial flow of current from the second RF source 60 to the first RF source 54 (paragraphs 34-38).

Preferably the sum of the areas of the exposed surfaces of rings 21 and 29 is about two times the sum of the areas of first and second electrodes 22 and 34 to assist in decoupling the high frequency power applied to electrode 22 from electrode 34 (paragraph 30), i.e., to provide a geometry such that current at the high frequency of source 54 has a tendency to flow to a greater extent between the first electrode 22 to the exposed surfaces of rings 21 and 29 in the excitation region 38 at the reference potential than from the first electrode 22 to the electrode 34 for carrying the workpiece (paragraphs 28, 30).

VI. Grounds of Rejection to be Reviewed on Appeal

A. The rejections of claims 21, 23-25, 27-35, 38-43 and 66-75 under 35 USC 112, paragraph 2. The Final

Rejection erroneously says canceled claim 36 is rejected under 35 USC 112, paragraph 2.

B. The rejection of claims 21, 23-25, 27-31, 33-35, 38-42, 66 and 70 under 35 USC 103(a) as being obvious from Li et al. (USP 6,178,919) in view of Lenz (USP 5,998,932). The Final Rejection erroneously says canceled claim 36 is rejected on this basis. During telephone conversations between the undersigned attorney for Appellant and Examiner Crowell, Examiner Crowell advised that this rejection would be withdrawn if changes suggested by the March 7, 2005 Advisory Action were made. Appellants have decided there is no need to make these suggested changes and is proceeding with this appeal.

C. The rejection of claims 32 and 43 under 35 USC 103(a) as being obvious from Li et al. (USP 6,178,919) in view of Lenz (USP 5,998,932) and further in view of Nakano et al. (USP 6,270,618). The Final Rejection erroneously says canceled claim 36 is rejected on this basis.

D. The rejection of claims 67-69 and 71-73 under 35 USC 103(a) as being obvious from Li et al. (USP 6,178,919) in view of Lenz (USP 5,998,932) and further in view of Lenz et al. (USP 5,534,751).

VII. Argument

Issue A. The rejection of Claims 21, 23-25, 27-36 and 66-75 under 35 USC §112, second paragraph.

1. The rejection of claims 24, 27-30, 33, 35 or 38-41 for lack of antecedent basis for the phrase "the electrode" is wrong.

The phrase "the electrode" is always followed by the adjective clause "for carrying the workpiece" which has antecedent basis. If the scope of the claim is reasonably ascertainable by those skilled in the art, the claim is not indefinite. *Ex parte Porter*, 25 USPQ2d 1144, 1145 (Bd. Pat. App. & Inter. 1992). In *Porter*, the Board held "controlled stream of fluid" provided reasonable antecedent basis for the controlled fluid." Similarly, in the present case, those skilled in the art would always understand that "the electrode for carrying the workpiece" is always referred to the same electrode. Hence, a member of the public is able to determine what "the electrode for carrying the workpiece" means and this language complies with 35 USC 112, paragraph 2.

2. The rejection of claims 27-30 and 38-40 under 35 USC §112, second paragraph, is incorrect.

The Examiner says it is unclear how "the excitation region geometry" relates to current flow. She also says it is unclear what structure is required to achieve the claimed geometry. Paragraph 14, page 8 of the Final Office Action refers to *In re Schreiber*, 128 F.3d 1473 147778, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997), *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990). However, these decisions have nothing to do with 35 USC §112, second paragraph,

but are concerned with the application of 35 USC §§ 102 and 103 to claims.

The Final Office Action ignores Applicants' citation of *In re Swinehart*, 439 F2d 210, 169 USPQ 226 (CCPA 1971) which indicates that functionality is not a proper basis for rejection of apparatus claims under 35 USC §112, second paragraph. In the *Swinehart* case, the functional language, relating to the opacity of material to optical energy, was the point of novelty over the prior art. The Court ruled the claims conformed with 35 USC §112, second paragraph. The functional language of claims 27-30 and 38-40 also complies with 35 USC 112, paragraph 2. A member of the public is able to ascertain if the geometry of a chamber has the sheath characteristics of claims 27 and 38 or the current flow characteristics of claims 28-30, 39 and 40. The Examiner has given no reason why these claims are "unclear."

In response to the comments in the Final Office Action about how geometry relates to current flow, there is no requirement for an applicant to understand how or why his invention works. In addition, the specification has considerable discussion of how geometry relates to current. Paragraph 18 includes language that is virtually the same as that employed in claims 27-30 and 38-40. Details of the geometry that is believed to achieve the functional requirements of claims 28-30, 39 and 40 are set forth in paragraph 30 of the specification. The sum of the areas of grounded rings 20 and 29 bounding the surface of excitation region 38 is about twice

as large as the individual area of each powered electrodes 22 and 34 bounding the surface of excitation region 38.

Appellants found such an area ratio assists in decoupling the high frequency RF power that source 54 applies to electrode 22 from electrode 34. Probably this is the reason why appellants found the high frequency current that source 54 applies to electrode 22 tends to flow to a greater extent between electrode 22 and the exposed surfaces of rings 21 and 29 as the reference potential (e.g., ground) than from electrode 22 to electrode 34, as required by claims 29, 30 and 40.

Appellants also found that the area ratio helped in developing a high DC bias across electrode 34 that is driven by low frequency 60. This high DC bias probably accounts for the requirements of claims 28 and 39 that Appellants found to exist, i.e., that current at the low frequency from source 60 has a greater tendency to flow between electrodes 34 and 22 than from electrode 34 to the exposed surfaces of rings 21 and 29. The high DC bias voltage may be accompanied by a high sheath capacitance, which in turn results in a lower relative sheath impedance associated with electrode 34. The lower relative sheath impedance associated with electrode 34 may increase the current flow from electrode 34 to electrode 22 that is opposite electrode 34.

The different sheaths set forth in claims 27 and 38 are probably established because, *inter alia*, the locations of (1) the

electrodes 22 and 34, and (2) the exposed surfaces of rings 21 and 29.

Appellants have set forth certain theories in this Brief as to why the excitation region geometry causes certain observed phenomena to occur. However, Appellants are not bound by these theories but advance them in an attempt to explain the mechanisms. The fact is Appellants observed these claimed phenomena and realized they were related, *inter alia*, to excitation region geometry. Based on *Swinehart*, Appellants are entitled to broad coverage on the correlation of excitation region geometry and the claimed phenomena of claims 27-30 or 38-40.

Issue B. The rejection of claims 21, 23-25, 27-31, 33-36, 38-42, 44-48, 66 and 70 as being unpatentable over Li et al. (USP 6,178,919) in view of Lenz (USP 5,998,932) is wrong.

Independent claims 21 and 33 include the requirements for (1) a first surface at a reference potential to be <u>between the louvers and the electrode for carrying the workpiece</u> and (2) a second surface at the reference potential to be located <u>between the louvers and the first electrode</u>. Because the Final Office Action fails to mention the emphasized limitations in analyzing claims 21 and 33, there is no attempt in the Final Office Action to establish a *prima facie* case for the features of claims 21 and 33.

The emphasized feature is not disclosed by either Li et al. or Lenz. Because surfaces 304a and 304b of Lenz do not extend inwardly of confinement rings 102, surfaces 304a and 304b are not

between the electrode and louver rings. Consequently, the rejections of claims 21 and 33, as well as the claims dependent thereon (which are rejected as being obvious as a result Li et al. and Lenz), are wrong.

The rejection of claims 28-30 and 39-41 as being obvious from Li et al. and Lenz is wrong. The Final Office Action alleges that because the combination of Li et al. and Lenz includes the structure of an electrode for carrying a workpiece, a first electrode and first and second surfaces at a reference potential, the resulting apparatus is capable of performing the functions Appellants found to occur as a result of the chamber excitation geometry.

This position is wrong as a matter of law. The mere fact that references <u>can</u> be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). In *Mills*, the claims were directed to an apparatus for producing an aerated cementitious composition by drawing air into the cementitious composition by driving an output pump at a velocity greater than the feed rate. The prior art reference taught that the feed means can be run at a variable speed. However, the court found that this does not mean that the output pump was run at the claimed speed so that air is drawn into the mixing chamber and is entrained in the ingredients during operation. Although a prior art device "may be capable of

being modified to run the way the apparatus is claimed, there must be a suggestion or motivation in the reference to do so." *Mills*, 916 F.2d at 68, 16 USPQ2d at 1432.). Hence, the mere fact that the proposed modification of Li et al. based on Lenz et al. could have produced the functions of claims 28-30 an 39-41 is not sufficient. Because the Final Office Action fails to indicate there is a suggestion or motivation in the prior art to arrive at an excitation region geometry that produces the results of any of claims 28-30 or 39-41, the Final Office Action makes no attempt to establish a *prima facie* case of obviousness with regard to these claims.

In addition, a statement that modifications of the prior art to meet the claimed invention would have been "'well within the ordinary skill of the art at the time the claimed invention was made" because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references. *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993). See also *In re Kotzab*, 217 F.3d 1365, 1371, 55 USPQ2d 131, 1318 (Fed. Cir. 2000). In *Levengood*, the Court reversed an obviousness rejection involving technologically simple concept. The rejection was reversed because there was no finding as to the principle or specific understanding within the knowledge of a skilled artisan that would have motivated the skilled artisan to make the claimed invention. Because the Final Office Action has provided no

objective reason to modify Li et al. and/or Lenz to arrive at a geometry that performs the functions of claims 28-30 or 39-41, the rejection of these claims is also wrong for this reason.

Issue C. The rejection of claims 32 and 43 as being obvious from Li et al., Lenz and Nakano et al. (USP 6,270,618) is incorrect.

Claims 32 and 43 depend on claims 21 and 33 and are allowable for the same reasons advanced *supra* with regard to claims 21 and 33. Nakano et al. obviously fails to cure the previously noted deficiencies in the rejection of claims 21 and 33.

Issue D. The rejection of claims 67-69 and 71-73 as being obvious as a result of Li et al., Lenz and Lenz et al. USP 5,534,751) is wrong.

Claims 67-69 and 71-73 depend on either claims 21 or 33 and are patentable for the same reasons advanced for claims 21 and 33. Lenz et al. fails to cure the previously noted deficiencies in the rejection of claims 21 and 33.

VIII. Conclusion

The rejections under 35 USC §112, second paragraph, are incorrect because (1) there is an antecedent basis for the phrase "the electrode for carrying the workpiece" and (2) there is no need to indicate in the broadest claims how excitation region geometry relates to sheath formation and/or current flow.

The rejection of the independent claims based on Li et al. and Lenz is wrong because neither reference discloses a first surface at a reference potential between a first electrode and louvers of a confinement structure and a second surface at the reference potential between an electrode that carries a workpiece and the confinement structure louvers.

The rejection, based on Li et al. and Lenz, of dependent claims that require the confinement structure geometry to produce certain results is incorrect because the applied references do not suggest the desirability of the modification. In addition, the applied references, together, do not disclose or make obvious all of the claimed parts of the confinement structure.

Reversal is in order.

Respectfully submitted,
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VIII. Claims Appendix

Claim 21. A vacuum plasma chamber for processing a workpiece, the chamber including: a first electrode for electrical coupling with gas in the chamber and for connection to a first relatively high frequency RF source, a second electrode for carrying the workpiece and electrical coupling with gas in the chamber and for connection to a second relatively low frequency RF source, an exterior wall at a reference potential, and a plasma excitation region for confining the plasma, the region being spaced from the exterior wall, wherein

the plasma excitation region including (a) louvers connected spaced from the wall, the plasma excitation region being arranged so that the gas flows into the plasma excitation region through the first electrode and out of the plasma excitation region between the louvers, and (b) first and second surfaces at the reference potential, the first surface being located between the louvers and the electrode for carrying the workpiece, the second surface being located between the louvers and the first electrode.

Claim 23. The chamber of claim 21 wherein the plasma excitation region is bounded by said electrodes and louvers.

Claim 24. The chamber of claim 21 wherein the plasma excitation region is symmetrical with respect to the chamber

exterior wall and a center point on the electrode for carrying the workpiece.

Claim 27. The chamber of claim 21 wherein the excitation region has a geometry such that different sheaths are developed between the plasma in the excitation region and between each of (a) the electrode for carrying the workpiece, (b) the first electrode and (c) the first and second surfaces at the reference potential.

Claim 28. The chamber of claim 27 wherein the excitation region geometry is such that current at the low frequency has a tendency to flow to a greater extent between the electrode for carrying the workpiece and the first electrode than from the electrode for carrying the workpiece to the surfaces of the excitation region at the reference potential.

Claim 29. The chamber of claim 28 wherein the excitation region geometry is such that current at the high frequency has a tendency to flow to a greater extent between the first electrode to the surfaces of the excitation region at the reference potential than from the first electrode to the electrode for carrying the workpiece.

Claim 30. The chamber of claim 27 wherein the excitation region geometry is such that current at the high frequency has a

tendency to flow to a greater extent between the first electrode to the surfaces of the excitation region at the reference potential than from the first electrode to the electrode for carrying the workpiece.

Claim 31. The chamber of claim 21 in combination with a processor including the first and second RF sources, the first RF source being connected to the first electrode, the second RF source being connected to the second electrode.

Claim 32. The combination of claim 31 further including a filter arrangement connected to the first and second RF sources and the first and second electrodes for: (1) enabling current from the first RF source to flow to the first electrode, (2) preventing the substantial flow of current from the first RF source to the second electrode and the second RF source, (3) enabling current from the second RF source to flow to the first and second electrodes, and (4) preventing the substantial flow of current from the second RF source to the first RF source.

Claim 33. A vacuum plasma chamber for processing a workpiece, the chamber including: a first electrode for electrical coupling with gas in the chamber and for connection to a first relatively high frequency RF source, a second electrode for carrying the workpiece and electrical coupling with gas in the chamber and for connection to a second relatively low

frequency RF source, an exterior wall at a reference potential, and a plasma excitation region for confining the plasma, the plasma excitation region including louvers at the reference potential and the first and second electrodes, the louvers being spaced from the exterior wall, the plasma excitation region being arranged for enabling gas to be excited to the plasma to flow into the plasma confinement region and out of the confinement region between the louvers, the plasma excitation region including first and second surfaces at the reference potential, the first surface being located between the louvers, and the electrode for carrying the workpiece, the second surface being located between the louvers and the first electrode.

Claim 34. The chamber of claim 33 wherein the plasma excitation region is bounded by said electrodes and louvers.

Claim 35. The chamber of claim 33 wherein the plasma excitation region is symmetrical with respect to the chamber exterior wall and a center point on the electrode for carrying the workpiece.

Claim 38. The chamber of claim 33 wherein the excitation region has a geometry such that different sheaths are developed between the plasma in the excitation region and between each of (a) the electrode for carrying the workpiece, (b) the first

electrode and (c) the first and second surfaces at the reference potential.

Claim 39. The chamber of claim 38 wherein the excitation region geometry is such that current at the low frequency has a tendency to flow to a greater extent between the electrode for carrying the workpiece and the first electrode than from the electrode for carrying the workpiece to the surfaces of the excitation region at the reference potential.

Claim 40. The chamber of claim 39 wherein the excitation region geometry is such that current at the high frequency has a tendency to flow to a greater extent between the first electrode to the surfaces of the excitation region at the reference potential than from the first electrode to the electrode for carrying the workpiece.

Claim 41. The chamber of claim 38 wherein the excitation region geometry is such that current at the high frequency has a tendency to flow to a greater extent between the first electrode to the surfaces of the excitation region at the reference potential than from the first electrode to the electrode for carrying the workpiece.

Claim 42. The chamber of claim 33 in combination with a processor including the first and second RF sources, the first RF

source being connected to the first electrode, the second RF source being connected to the second electrode.

Claim 43. The combination of claim 42 further including a filter arrangement connected to the first and second RF sources and the first and second electrodes for: (1) enabling current from the first RF source to flow to the first electrode, (2) preventing the substantial flow of current from the first RF source to the second electrode and the second RF source, (3) enabling current from the second RF source to flow to the first and second electrodes, and (4) preventing the substantial flow of current from the second RF source to the first RF source.

Claim 66. The chamber of claim 21 wherein the louvers have high electrical conductivity and are at the reference potential.

Claim 67. The chamber of claim 21 wherein the louvers have low electrical conductivity and float electrically and are arranged to mechanically confine the plasma.

Claim 68. The chamber of claim 67 wherein the spacing between adjacent pairs of the louvers is such as to provide the mechanical confinement.

Claim 69. The chamber of claim 68 wherein the spacing is adjustable.

Claim 70. The chamber of claim 33 wherein the louvers have high electrical conductivity and are at the reference potential.

Claim 71. The chamber of claim 33 wherein the louvers have low electrical conductivity and float electrically and are arranged to mechanically confine the plasma.

Claim 72. The chamber of claim 71 wherein the spacing between adjacent pairs of the louvers is such as to provide the mechanical confinement.

Claim 73. The chamber of claim 72 wherein the spacing is adjustable.

Claim 74. The chamber of claim 21 wherein the sum of the areas of the first and second surfaces is about two times the sum of the areas of the first and second electrodes.

Claim 75. The chamber of claim 33 wherein the sum of the areas of the first and second surfaces is about two times the sum of the areas of the first and second electrodes.